DOCUMENT RESUME

ED 391 507 IR 017 660

AUTHOR Gibbs, William J.
TITLE Computer-based Testing and Strategies for Distance Learning.
PUB DATE [95]
NOTE 7p.; In: Eyes on the Future: Converging Images, Ideas, and Instruction. Selected Readings from the Annual Conference of the International Visual Literacy Association (27th, Chicago, IL, October 18-22, 1995); see IR 017 629. Figures may not reproduce well.
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Testing; *Computer Software Development; Distance Education; Educational Technology; Feedback; *Programmed Instructional Materials; Student Reaction; *Teacher Developed Materials; Teacher Education; *Test Construction
IDENTIFIERS *Test Analysis

ABSTRACT

TestMaker is a project in which computer-based programs are being developed to help educators create tests. The program was designed as an instructional and developmental tool for teacher-education students. TestMaker consists of four modules: Advisement; Test Creation; Student Test; and Presentation Analysis. The Advisement module runs concurrently with the Test Creation module and provides users with system-generated advice and user-selected advice related to effective test construction. All question items, correct answers, alternatives, and feedback created in the Test Creation module are presented in the Student Test module; during testing, student responses, elaboration and instructional time are recorded in a file which can later be reviewed by the instructor. The Presentation Analysis module was designed as a presentation tool for distance learning; it assists in the analysis of questions by allowing the instructor to log the number of students agreeing and disagreeing with each question alternative. Future developments with the TestMaker project will investigate the possibility of testing students at remote distance learning sites. (Contains 11 references.) (AEF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Alice D. Walker
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC).

Computer-Based Testing And Strategies for Distance Learning

William J. Gibbs

ED 391 507

Introduction

The assimilation of computer technology in society has enabled computers to be used for a variety of educational purposes with some standard uses being in the area of learner assessment (Eaves & Smith, 1986). While paper-and-pencil tests have been a standard means of educational measurement (Olsen, Maynes, Slawson, & Ho, 1989), assessment methods are changing and will continue to change with the development of more advanced computer-based learning environments.

In terms of educational measurement, computers serve many functions and offer some distinct advantages over traditional methods. From an administrative perspective, computers provide an accurate experimental tool with which to conduct and manage learner assessment. They can control many of the routine tasks or clerical duties associated with such processes. Computers increase efficiency in test duplication, administration, scoring, item banking, record keeping and analysis (Eaves and Smith, 1986) and offer more organized assessment (Johnson and Harlow, 1989).

From an instructional perspective, computers enable standardized testing conditions, individually administered tests, immediate test scoring, increased variety of testing formats, and ability to collect test and item latency information (Olsen, Maynes, Slawson, and Ho, 1989). They are capable of presenting test items and evaluating them. For example, many computer testing systems generate unique question sets for each learner. Based on previous responses to questions, the computer determines which questions are appropriate for each individual (Cudeck, Cliff and Kehoe, 1977). Computer-based tests give educators the capability of providing learners immediate feedback or knowledge of results. With paper-and-pencil tests, there is often a considerable time lapse between the time of testing and the time at which test results are reported. Finally, computers have the advantage of being completely objective, which is not possible with humans (Johnson and Harlow, 1989).

Computer-Based Testing

The research literature appears to support the claim that computer and paper-and-pencil test administration produce comparable results in learner achievement scores. Stile and Pettibone (1983), for example, found no significant differences in acquired scores when comparing computer testing to paper-and-pencil. Eaves and Smith (1986) report that undergraduate college students' achievement scores on computer administered tests are similar to that of paper-and-pencil.

Assessment is a fundamental part of education. Traditionally, multiple-choice and true/false tests have been the predominant means of assessment. While

IR 017660

2

BEST COPY AVAILABLE

used heavily, and appropriate in many cases, current educational perspectives (e.g., constructivists approaches) require that assessment also focus on higher order thinking and problem-solving abilities.

A potential advantage of computerized testing is the capability to allow users to interact with tests. Research suggests that allowing for interaction during testing promotes learning. For example, giving learners the opportunity to respond to feedback has been shown to facilitate higher levels of achievement (Marrone, 1991). Activities during computerized testing which help learners relate new information to existing knowledge (e.g., responding to feedback) may prove beneficial to learning and should be considered by instructional designers. It is possible that as computerized testing procedures become more interactive and dynamic, higher order learning may be facilitated.

Purpose of Paper

This paper reviews the TestMaker project in which computer-based programs are being developed to help educators create tests. Interactive testing, record keeping and advisement on test creation are discussed. Also presented is a discussion of a computer-based module developed for this project, which is being used for distance learning instruction. The module provides for presentation and analysis of question items and feedback during class lectures.

TestMaker Objectives

The development of TestMaker was initiated by requests from faculty at Eastern Illinois University for a computer-based test development and learning tool that would 1) provide instruction on effective strategies for creating tests and 2) assist in the creation of computerized tests that evaluate and record student performance. The program was designed as an instructional and developmental tool for teacher-education students. Recently, the program was expanded to include a Presentation Analysis module which enables educators during their class lectures to present questions to the class, ask for feedback and graph class responses. The objectives of this project were to:

1. create a test development module that provides students instruction and help with creating tests,

2. create a computerized test development tool that facilitates easy test creation to meet an expressed need of faculty,

3. develop a computer-based module that incorporates testing strategies aimed at facilitating higher order learning,

4. develop a computer-based module to be used for distance learning instruction that enables instructors to review and analyze question items and feedback during class lectures.

Overview of Prototype Design

TestMaker is a prototype that consists of four modules: 1) Advisement, 2) Test Creation, 3) Student Test, and 4) Presentation Analysis. Currently, the Test Creation module enables users to create multiple-choice tests. From a question template screen, test items and feedback are entered and subsequently a student test file is created. The Advisement module runs concurrently with the Test Creation module. It provides advice and information on such topics related to effective test construction. At any point during test creation, users have the option to execute the Advisement module. Once all test items are entered, a test is created. This allows students sitting at a computer to take the test, interact with it and receive feedback on their performance. The Presentation Analysis module assists in the analysis of test items for class lectures and test reviews. Each module is discussed in more detail below.

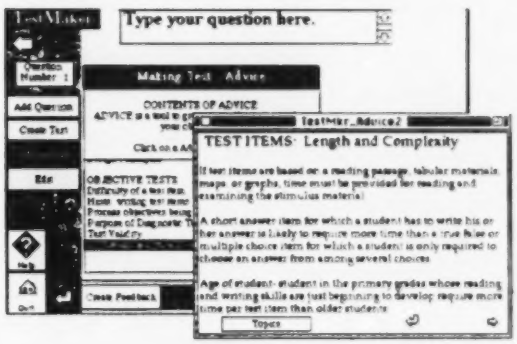
Modules of TestMaker

Advisement Module

The Advisement module provides users with two types of advisement: system-generated advice and user-selected advice. As tests are being created, the system will prompt users when it appears that an item violates test construction guidelines. This is referred to as system-generated advice. For example, if a user attempts to enter twelve alternatives for a multiple choice question, the system will advise the user that this may be inappropriate.

User-selected advice operates concurrently with the test creation program. When selected, this option presents a scrolling list of topics. With the computer's mouse, users click on key words in the list and are presented a window of information on the topic. The Advisement module provides information on such topics as types of feedback, designing feedback for intellectual skills instruction, test item length and complexity, hints for writing test items, and test validity (see Figure 1).

Figure 1
TestMaker: Advisement Module



Test Creation Module

To create a multiple choice test, users enter each question and a set of alternatives by typing in pre-defined text blocks. Once questions and alternatives have been entered, the system prompts the user to choose a correct answer. This is done by clicking on the correct answer for a particular question. Previously entered questions and alternatives can be viewed and edited in the system's edit mode. This mode allows for each question to be modified. Additionally, all test items can be viewed together and altered as needed.

For each question created with the module, users can incorporate feedback which will be displayed for students during testing. Numerous studies indicate that learning is effected by practice and feedback. Giving learners feedback as to their progress in a particular subject is an essential ingredient of effective instruction. Consistent feedback helps to motivate learners in learning pursuits; it gives them knowledge of their performance and it enables the instructor to assess progress made by individuals (Corcoran, 1985). Types of feedback range from merely presenting results to presenting in-depth explanations about responses (Lee-Sammons & Wollen, 1989).

As a form of feedback, the correct answer can be presented for incorrect responses. Thus, if the instructor enters feedback and selects the correct answer display option, the student, upon responding incorrectly to a test item, would be presented the correct answer along with the instructor's feedback. Providing students knowledge of correct responses may be a useful strategy. The process of comparing and judging responses may serve a as means to increase interaction and to subsequently invoke deeper cognitive processing. It may encourage learners to think about their own work which can add substantially to assessments (Tittle, 1991).

The type of information processing in which learners engage during instruction impacts the degree of learning that takes place. Therefore, a critical factor in designing learner responses is the level of processing they invoke in learners (Jonassen & Hannum, 1987). The test creation module has an option for interaction during testing. While still under development, the purpose of this feature is

BEST COPY AVAILABLE

to allow test takers to respond to feedback, explain their answers and/or to justify why they are right or wrong. For example, if the instructor had selected this option, students, upon responding to a particular test item, would be prompted to elaborate as to why their response was correct. The student would then type an explanation which could later be reviewed by the instructor. This type of elaboration is hypothesized to facilitate information recall by providing additional information for the formulation of responses (Gagné, 1985). Activities such as elaboration may help learners organize information and thus assist them with integrating new information with their existing knowledge (Park & Hannafin, 1993). In this respect, the testing experience itself becomes a type of learning strategy which helps to facilitate learning.

Student Test Module

The test file is generated from the test creation module. Once generated, it can be given to students on disk or over a local area network. All question items, correct answers, alternatives and feedback created in the Test Creation module are presented. During testing, student responses, elaboration and instructional time are recorded to a file which can later be reviewed by the instructor. Upon completion, students are given a grade.

Presentation Analysis Module

The Presentation Analysis module was designed as a presentation tool for distance learning. It resulted from an instructor's need to present, analyze and discuss multiple choice questions during class lectures. In reviewing a particular class topic, the instructor would present a question to students and have them discuss it to determine the correct answer. This was originally done with paper-and-pencil. However, when designing class materials for distance learning, the instructor saw a need to provide a more thorough analysis of questions and thus the Presentation Analysis module was developed.

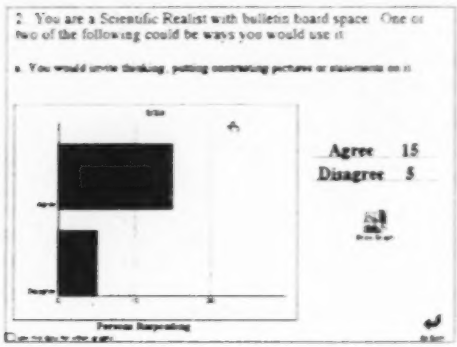
Since the program is used for distance learning, much consideration had to be given to visual design. In a distance learning environment, a scan converter is used to convert the computer's output to an analog signal that the distance learning system could recognize. Typically, in this conversion process, some degradation in image quality results. Moreover, distance learning systems require that attention be given to the design of visual materials. Therefore, font sizes should be sufficiently large enough in order for the visual to be read easily. A font of 24 points is often suggested as an adequate size. However, multiple choice questions when entered into the module at a 24 point font size tend to clutter the screen. Depending on the amount of text in the question being displayed, words were often outside viewers' visual field. To circumvent this problem, text size was made adjustable. Therefore, any word on screen, if clicked, would enlarge to a bold 24 point font size and subsequently reduce to a non-bold 18 point font size when clicked for a second time. This served two purposes. First, it helped to ensure that text could be viewed. Second, adjusting font sizes served as a cueing device to direct viewers' attention to the specific points being discussed.

This module assists in the analysis of questions by allowing the instructor to log the number of students agreeing and disagreeing with each alternative. For example, the instructor can highlight a particular question alternative and ask students if they agree or disagree as to whether it is correct. The number of students agreeing or disagreeing can be entered and dynamically graphed for students to view at the remote sites.

The module keeps a running tally sheet of the number of students agreeing and disagreeing with each question alternative. This is useful for determining the concepts students understand and those which they do not understand. The number of questions and the sequence in which they are presented is tracked by the system. For instance, an instructor may choose to review questions out of order.

At any point during a lecture, the instructor can view the tally sheet and determine those questions which were viewed and those that were not. Figure 2 depicts the analysis mode of the module.

Figure 2
Presentation Analysis Module



Each question alternative can have feedback associated with it explaining why it is correct or incorrect. By selecting the Feedback Option and then clicking any alternative, feedback for that item is displayed. All questions and feedback can be easily updated and new items can be imported from a word processor.

The Presentation Analysis and Test Creation modules are integrated. Once test items are entered during test creation, they are transferred and formatted into the Presentation Analysis module.

Further Developments

As the World-Wide-Web (WWW) expands, so does the potential to provide distance learning opportunities. While rapid, seemingly unprecedented developments occur with World-Wide-Web browsers such as Netscape, the interactivity required for computer-based testing is not yet available. However, it is inevitable that further developments will expand the degree to which users can interact with WWW documents. It is the author's plan to integrate the TestMaker modules with the WWW. For distance learning purposes, a web page can be set up so that instructors and students at any location will be able to access a form in which to enter test items. This information can then be sent to a server containing the Presentation Analysis module which will import and format these items for analysis and presentation to remote sites. For example, a teacher-education instructor teaching concepts of test construction to two remote sites could ask each site to work in groups to generate objective test items for a particular topic. Test items could be entered into the WWW form and sent to the Presentation Analysis module for importing and formatting. They could subsequently be presented to both sites for students to critique and analyze.

Future developments with the TestMaker project will investigate the possibility of testing students at remote distance learning sites. While there are many issues which must be taken into account with remote testing (e.g., test security, cheating), it may provide worthwhile benefits. Test items could be posted on the World-Wide-Web. The Presentation Analysis module could receive students responses (e.g., entered via the WWW) to questions. The instructor could import the data into the module and subsequently analyze it. At a minimum, this could reduce instructor time spent on grading, as well as provide for easy updating of test items. Also, compared to paper-and-pencil tests, this approach, given the analysis capabilities of the Presentation Analysis module, would provide for more thorough test reviews and analysis during class lectures.

Summary

In recent years, it has become apparent that computers serve many functions and offer distinct advantages over some traditional educational assessment methods. In many instructional settings, computers manage the routine tasks related to assessment. They are capable of presenting test items and evaluating them. Computer-based tests, among other things, give educators the capability of providing immediate feedback

BEST COPY AVAILABLE

or knowledge of results to learners and interaction during testing. This paper discussed a project aimed at providing educators with a means by which to develop computer-based tests. The project investigates instructional strategies such as interaction during testing that may help students generate their own meaning from information and subsequently construct knowledge. Means to present and analyze test items for distance learning classes were also discussed. Currently, delivering objective tests over a distance is often difficult. While the approaches for distance learning testing presented in this paper do not resolve many of these issues, they do provide educators with some strategies for testing and learning. As developments in the World-Wide-Web continue, it may eventually be possible to provide effective testing methods and associated instructional strategies at a distance.

References

Corcoran, K.J. (1985). Student self-assessment as a teaching tool: A pilot study of the sequential criterion-referenced educational evaluation system. *Journal of Social Work Education*, 21(2), 54-59.

Cudeck, R.A., Cliff, N. & Kehoe, J.F. (1977). Tailor: A FORTRAN Procedure for Interactive Tailored Testing. *Educational and Psychological Measurement*, 37,767-769.

Eaves, R. C. & Smith, E. (1986). The effect of media and amount of microcomputer experience on examination scores. *Journal of Experiential Education*, 55(1), 23-36.

Gagné, E. (1985). *The cognitive psychology of school learning*. Boston: Little, Brown and Company.

Johnson, D. L. & Harlow, S. D. (1989). Using the computer in educational assessment: Can it be of any help? *Diagnostique*, 14(3), 274-281.

Jonassen, D.H. & Hannum,W.H. (1987). Research-Based Principles for Designing Computer Software. *Educational Technology*, 27(12), 56-62.

Lee-Sammons, W. H. & Wollen, K. A. (1989). Computerized practice tests and effects on in-class exams. *Behavior Research Methods, Instruments & Computers*. 21(2), 189-194.

Marrone, J. A. (1990). Learner response to computerized answer judging and its effect on learning and retention. Doctoral dissertation, The Pennsylvania State University.

Olsen, J. B., Maynes, D. D., Slawson, D. & Ho, K. (1989). Comparisons of paper-administered,computer-administered,computer-adaptive achievement test. *Journal of Computing Research*, 5(3), 311-326.

Park, I., & Hannafin, M. J. (1993). Empirically-based guidelines for the design of interactive multimedia. *Education Technology Research and Development*, 41(3), 63-85.

Stile, S. & Pettibone, T. J. (1983). Micro-computer assisted student examination in special education training. *Teacher Education and Special Education*, 6, 192-195.

Tittle, C. K. (1991). Changing models of student and teacher assessment. *Educational Psychologist*, 26(2), 157-165.